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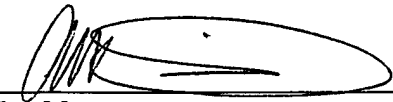


#4

PATENT

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Alex Martinez

Applicant : Christopher Brian Latham, et al.  
Application No. : 09/894,814  
Filed : June 27, 2001  
Title : DEVICE CONTROLLER AND CONTROL  
ARRANGEMENT  
Grp./Div. : 2635  
Examiner : N/A  
Docket No. : 45542/DBP/T183

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Assistant Commissioner for Patents  
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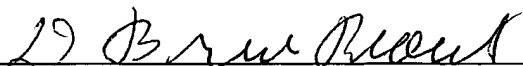
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September 28, 2001

Commissioner:

Enclosed is a certified copy of United Kingdom patent Application No. 0015559.8, which was filed on June 27, 2000, the priority of which is claimed in the above-identified application.

Respectfully submitted,

CHRISTIE, PARKER &amp; HALE, LLP

By   
D. Bruce Prout  
Reg. No. 20,958  
626/795-9900

DBP/aam  
Enclosure: Certified copy of patent application



INVESTOR IN PEOPLE

The Patent Office  
Concept House  
Cardiff Road  
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Dated

03 JUL 2001

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Continuation sheets of this form

Description

Claims(s)

Abstract

Drawing(s)

1

10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77)

Request for substantive examination (Patents Form 10/77)

Any other documents (Please specify)

11.

I/We request the grant of a patent on the basis of this application

Signature

Date 26/06/2000

*W.P. Thompson & Co*

12. Name and daytime telephone number of person to contact in the United Kingdom

R.J. BARTLE  
0151-709-3961.

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27 JUN 2000

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# Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

THE PATENT OFFICE  
27 JUN 2000  
NEWPORT

The Patent Office  
Cardiff Road  
Newport  
Gwent NP9 1RH

1. Your reference DIH/RJB/P403282GB
2. Patent application number  
(The Patent Office will fill in this part) 0015559.8
3. Full name, address and postcode of the or of each applicant (underline all surnames)  
  
Patents ADP number (if you know it)  
  
If the applicant is a corporate body, give the country/state of its incorporation  

**Oxley Developments Company Limited,**  
Priory Park,  
Ulverston,  
Cumbria,  
LA12 9QG.  
*647842001*  
ENGLAND.
4. Title of the invention DEVICE CONTROLLER AND CONTROL ARRANGEMENT.
5. Name of your agent (if you have one) W.P.THOMPSON & CO.  
  
"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)  

Coopers Building,  
Church Street,  
Liverpool,  
L1 3AB.

  
  
Patents ADP number (if you know it) 0000158001 /
6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and (if you know it) the or each application number  

Country	Priority application number (if you know it)	Date of filing (Day/month/year)
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7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application  

Number of earlier application	Date of filing (Day/month/year)
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8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'yes' if:  
a) any applicant named in part 3 is not an inventor, or  
b) there is an inventor who is not named as an applicant, or  
c) any named applicant is a corporate body.  
See note (d)) YES

DESCRIPTIONDEVICE CONTROLLER AND CONTROL ARRANGEMENT

The present invention is concerned with control of electrical and electronic devices.

A specific application of the present invention concerns aircraft lighting. The use of infra red sensitive viewing systems such as night vision goggles (NVGs) is making it necessary to retro-fit aircraft with exterior lights which are switchable between visible and infra red light emission. Infra red lighting, particularly on military aircraft, enables the aircraft to be visible to other aircraft flying using NVGs. The applicant's own granted U.S. Patent 6011493 describes a suitable light which can be substituted for a conventional light. It is necessary for the pilot to be able to switch, from the cockpit, between visible and infra red emission. Additionally it is desirable that the lighting should, under control from the cockpit, be able to flash in various on - off patterns to aid conspicuity in various flying conditions.

Typically existing aircraft wiring e.g. to wingtip lights, having been designed to drive only visible lighting, comprises only power supply and earth (or two electrical lines for an A.C. supply). Re-wiring to include further lines, to allow control and drive of two lights (visible and infra red) through separate lines would be complex and expensive so it is desirable to provide for the required control of both visible and infra red emitters using only the existing lines.

It is also desirable to provide for this control without need for separate

electronic control signals which could give rise to difficulties as concerns electromagnetic compatibility.

While the present invention has been devised to address the above requirements concerning aircraft lighting, it has numerous other applications. Broadly stated, the aim of the present invention is to provide for control of an electrical or electronic device through the device's power supply lines.

In accordance with a first aspect of the present invention, there is a controller for controlling a device driven by an AC supply, the controller being adapted to intermittently interrupt the AC supply such as to encode a control signal therein.

In this way the lines used to carry the AC supply itself can be made also to carry the signal required to control a remote device.

In accordance with a second aspect of the present invention there is a control arrangement for controlling a device, comprising an AC supply, a controller adapted to intermittently interrupt the AC supply such as to encode a control signal therein, an AC supply line for conducting the encoded AC supply to the device and a detector for receiving the AC supply, decoding the control signal and controlling the device in dependence thereupon.

The AC supply may for example be provided by connecting the controller to AC mains.

The controller and the control arrangement according to the present invention make it unnecessary to provide signals or power separate from the AC supply itself, reducing or removing any electromagnetic compatibility problems (an important

issue e.g. in the example of aircraft lighting) and making for a simple and convenient arrangement.

The controller and the control arrangement according to the present invention are particularly advantageous where, as in the aircraft lighting example, it is necessary to modify an existing circuit to provide for control of the device without adding new wiring to the device.

It is particularly preferred that the controller is adapted to begin and end interruptions of the AC supply when the supply potential is substantially zero. This is sometimes referred to as a "zero crossing" method. By carrying out switching when the potential is zero, or at least close to zero, it is ensured that no electromagnetic interference is produced.

Interruptions of the AC supply are preferably one AC cycle in duration. This is consistent with zero crossing.

It is particularly preferred that the controller is such as to interrupt the AC every X cycles, where X is adjustable and different values of X represent different control signals. The controller preferably receives control input (e.g. from switches controlled by a user) and adjusts X to correspondingly control the device.

According to an especially preferred embodiment of the present invention the control arrangement is for controlling exterior aircraft lighting. In such an embodiment the controller may be mounted in or adjacent to the cockpit and connected by the AC supply line to an exterior aircraft light provided with the detector. Preferably the aircraft light has a visible light emitter and an infra red



emitter both controllable by the controller.

A specific example of the present invention will now be described, by way of example only, with reference to accompanying Fig. 1 which is a simplified block diagram of a light control system according to the present invention.

The illustrated light control system is suitable for control of aircraft lights. It can be used to facilitate retro-fitting of switchable visible/infra red lights to existing aircraft using existing aircraft wiring originally intended for visible lights only.

As the drawing indicates, the control system comprises a controller in the form of a modulator 1 which modulates an AC supply taken from the aircraft mains. The modulator is under the control of the pilot (e.g. through cockpit mounted light switches) and modulates the AC supply such as to encode a control signal therein.

The modulator 1 is mounted in the vicinity of the cockpit. The modulated AC signal is conducted through existing aircraft wiring 3 to a light at a remote location on the aircraft, e.g. the wingtip. The wiring 3 need only include the existing lines intended to supply AC power to the light.

The modulated AC signal is led first to a detector 5 which is mounted in, or in the vicinity of, the light itself. The detector 5 comprises a microprocessor which decodes the control signal carried by the AC and in response thereto (and so under control from the modulator 1) selectively directs the AC to one of the light sources (an example of which is shown as an LED at 7) to provide the required light - visible, infra red, flashing etc.

The light sources themselves can use solid state visible and infra red LEDs.

Additionally or alternatively conventional incandescent bulbs may be used.

In the illustrated embodiment the modulator encodes the control signal by selectively removing one cycle of the AC supply every  $X$  cycles, where the ratio  $X$  is adjusted according to the control input from the pilot. The ratio  $X$  is monitored by the detector 5 which switches the light to different modes in response to different  $X$  values.

In the drawing, a removed AC cycle is shown in dotted lines. It can be seen that the removed cycle begins and ends at instants of zero supply potential ("zero crossing") so that there can be no possibility of electromagnetic interference being generated by the switching.

The arrangement described above is particularly suited to control of LED lighting on aircraft where electromagnetic interference issues can be safety critical and where the detector microprocessor can also conveniently include any necessary power regulation and temperature compensation.

However, the present invention could have many "non invasive" applications not only in 400Hz aircraft systems but also in mains systems (e.g. at 50Hz) and wherever relatively slow (msec) control is adequate.

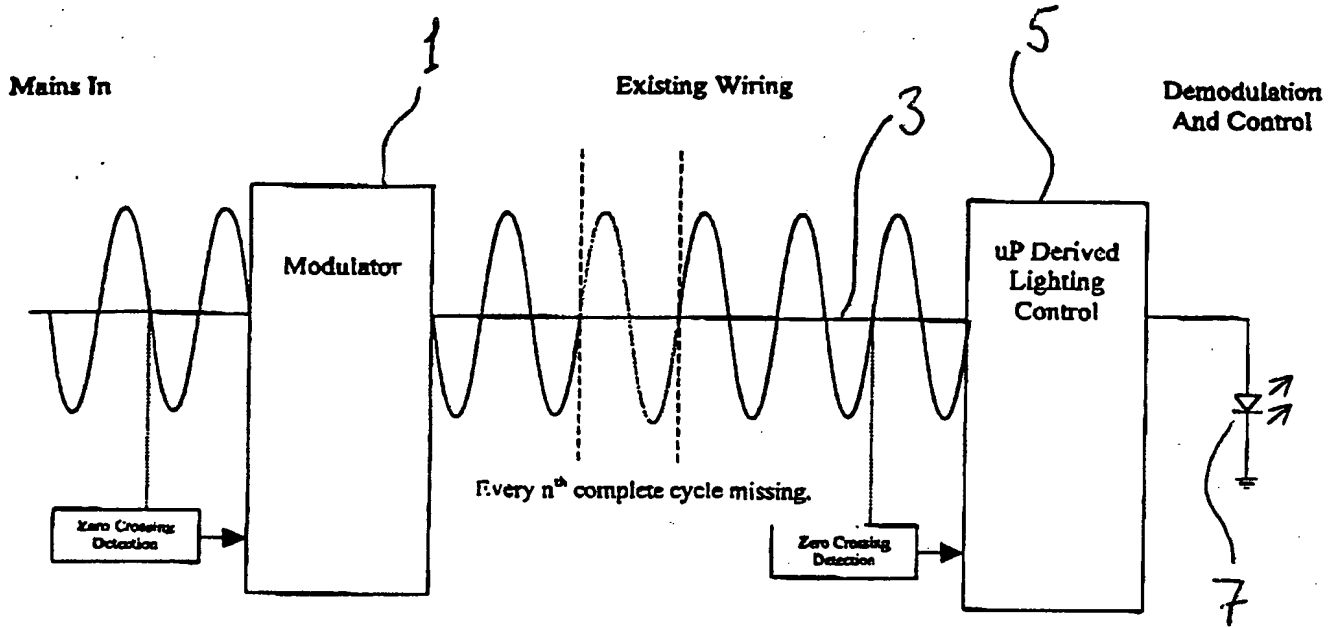


Fig.1